A Study on Wet Deployable Materials

By Jonathon Baker
Advisors: Nickolay Kulakov, Vijoya Sa, and Dr. Kostya Kornev

A wet deployable material is a material that changes its shape when it comes in contact with water. Nothing like this approach has ever been seriously studied before. I have spent the past 2 weeks studying one of the many wet deployment systems possible. It is a small part of a 3 year project. The specific mechanism I studied is a roll of fabric with sodium polyacrylate (baby diaper powder) inside of it. I made small 130 cm^2 rolls of fabric which took about an hour each to prepare. They were sewn by hand and measured, analyzed, photographed, video-taped, recorded, and stored in Petri dishes taped together by date after being taped in rolls and dropped into water. The results were astonishing. Sodium polyacrylate can absorb over 200 times its own weight in water. But the super-absorbent particles used in my system were extracted from baby diapers and which shown absorption capacity of around 100 times. A sample could fully unroll itself within 2 minutes. Essentially, the expansion of the sodium polyacrylate is converted into mechanical energy to unroll the fabric. The eventual application is that a large roll of this light weight material can be rolled up and air dropped onto the polluted water. It can unroll itself, absorbs contamination, and prevent any more noxious chemicals from vaporizing. One of the final tests conducted was in 400 ml water and 100 ml machine oil. That test was not as successful as the other ones. Instead of floating on top and expanding, the sample sank and took an hour to expand, when it should have only taken 5 minutes. From this I learned that the current mechanism will not work unless it directly touches water. But I basically focused on optimizing and understanding the mechanisms, as in how many “ribs” (threads down the length of the expansion to act as levers) was most efficient, and how much powder would expand the samples the quickest which was completed successfully.